WE CLAIM:

1. A plate for holding a plurality of samples, comprising:

a frame;

a plurality of sample wells disposed in the frame; and

a corresponding plurality of thermal reference regions disposed adjacent the sample wells in the frame;

where the thermal reference regions have an emissivity of at least about 0.5; and

where thermal infrared radiation detected from a sample positioned in at least one of the sample wells may be calibrated using thermal infrared radiation detected from an adjacent thermal reference region.

2. The plate of claim 1, the frame being substantially rectangular, where the length of the frame ranges between about 125 mm and about 130 mm, and where the width of the frame ranges between about 80 mm and about 90 mm.

3. The plate of claim 1, where the number of sample wells in the plate is selected from the group consisting of 96, 384, 768, 1536, 3456, and 9600.

4. The plate of claim 1, where the density of sample wells in the plate is at least about 1 well per 81 mm^2.

5. The plate of claim 1, where the volume of each sample well in the plate is less than about 500 microliters.

6. The plate of claim 1, where the sample wells and the thermal reference regions are composed at least in part of different materials.

7. The plate of claim 1, where the thermal reference regions have an emissivity of at least about 0.8.

8. The plate of claim 1, where the thermal reference regions are positioned on a support structure, and where the thermal mass of the thermal reference regions and associated support structures is greater than the thermal mass of the sample wells and corresponding samples.

9. The plate of claim 1, where each thermal reference region includes an annular portion distributed adjacent a perimeter of a corresponding sample well.

10. The plate of claim 1, the sample wells having a central axis, where each thermal reference region includes an annular portion positioned about the central axis of a corresponding sample well.

11. The plate of claim 10, where the thermal reference regions are symmetric about the central axis.

12. The plate of claim 1, the sample wells having a top, where each thermal reference region is positioned about or above the top of a corresponding sample well.

13. The plate of claim 1, the sample wells having a bottom, where each thermal reference region is positioned about or below the bottom of a corresponding sample well.

14. The plate of claim 1, where the sample wells and corresponding thermal reference regions are separated by a gap along a line connecting each portion of the sample wells and the corresponding thermal reference regions to reduce heat transfer between the sample wells and the thermal reference regions.

15. The plate of claim 14, where the gap is filled with air.

16. The plate of claim 1, each thermal reference region having an emissive reference surface, where the emissive reference surface includes a metal.

17. The plate of claim 16, where the metal is aluminum.

18. The plate of claim 1, each thermal reference region having an emissive reference surface, where the emissive reference surface is substantially flat.

19. The plate of claim 18, each sample well having a bottom, at least a portion of the bottom being substantially flat, where the flat portion of the bottom of each sample well is substantially parallel to the emissive reference surface of the corresponding thermal reference region.

20. The plate of claim 19, each sample well having a bottom, at least a portion of the bottom being substantially flat, where the area of the flat portion of the bottom of each sample well is within a factor of ten of the area of the emissive reference surface of the corresponding thermal reference region.

21. The plate of claim 1, where the thermal reference regions are positioned at an end of a support member disposed between the sample wells.

22. A plate for holding a plurality of samples, comprising:

a frame;

a plurality of sample wells disposed in the frame, the sample wells having a top and a bottom; and

a corresponding plurality of thermal reference regions disposed adjacent the sample wells in the frame;

where the sample wells and corresponding thermal reference regions are separated by a gap along a line connecting each portion of the sample wells and the corresponding thermal reference regions to reduce heat transfer between the sample wells and the thermal reference regions; and

where thermal infrared radiation detected from a sample positioned in at least one of the sample wells may be calibrated using thermal infrared radiation detected from an adjacent thermal reference region.

23. The plate of claim 22, where the gap is filled with air.

24. The plate of claim 22, where the sample wells and the thermal reference regions are composed at least in part of different materials.

25. The plate of claim 22, where the thermal reference regions have an emissivity of at least about 0.5.

26. The plate of claim 22, where the thermal reference regions and associated support structure have a higher thermal mass than the sample wells and corresponding samples.

27. The plate of claim 22, the sample wells having a central axis, where each thermal reference region includes an annular portion positioned about the central axis of a corresponding sample well.

28. The plate of claim 22, the sample wells having a bottom, where each thermal reference region is positioned about or below the bottom of a corresponding sample well.

29. The plate of claim 22, each thermal reference region having an emissive reference surface, where the emissive reference surface includes a metal.

30. A plate for holding a plurality of samples, comprising:

a sample holder having a plurality of sample wells; and

a thermal isolation member for supporting the sample holder so that each sample well can be precisely positioned along an optical path, the thermal isolation member providing a thermally controlled thermal reference surface adjacent each well as viewed along the optical path.

31. The plate of claim 30, where each reference surface defines an aperture framing the associated optical path.

32. The plate of claim 30, where the sample wells and the thermal reference regions are composed at least in part of different materials.

33. The plate of claim 30, where the thermal reference regions have an emissivity of at least about 0.5.

34. The plate of claim 30, where the thermal reference regions and associated support structure have a higher thermal mass than the sample wells and corresponding samples.

35. The plate of claim 30, the sample wells having a central axis, where each thermal reference region includes an annular portion positioned about the central axis of a corresponding sample well.

36. The plate of claim 30, the sample wells having a bottom, where each thermal reference region is positioned about or below the bottom of a corresponding sample well.

37. The plate of claim 30, where the sample wells and corresponding thermal reference regions are separated by a gap along a line connecting each portion of the sample wells and the corresponding thermal reference regions to reduce heat transfer between the sample wells and thermal the reference regions.

38. The plate of claim 30, where each thermal reference surface comprises metal.

39. A method of detecting thermal infrared radiation, comprising:

providing a sample plate having a plurality of sample wells and a corresponding plurality of thermal reference regions positioned adjacent the sample wells;

providing an optical device configured preferentially to detect thermal infrared radiation;

detecting thermal infrared radiation transmitted from a sample positioned within at least one of the sample wells using the optical device;

detecting thermal infrared radiation transmitted from a thermal reference region positioned adjacent the sample well holding the sample using the optical device; and

constructing a sample signal characteristic of the thermal infrared radiation detected from the sample based on the thermal infrared radiation detected from the sample and the adjacent thermal reference region.

40. The method of claim 39, further comprising correlating the detected radiation with the progress of a chemical or physiological reaction occurring within the sample.

41. The method of claim 39, the frame being substantially rectangular, where the length of the frame ranges between about 125 mm and about 130 mm, and where the width of the frame ranges between about 80 mm and about 90 mm.

42. The method of claim 39, where the number of sample wells in the sample plate is selected from the group consisting of 96, 384, 768, 1536, 3456, and 9600.

43. The method of claim 39, where the density of sample wells in the sample plate is at least about 1 well per 81 mm^2.

44. The method of claim 39, where the volume of each sample well in the sample plate is less than about 500 microliters.

45. The method of claim 39, where the sample wells and the thermal reference regions are composed at least in part of different materials.

46. The method of claim 39, where the thermal reference regions have an emissivity of at least about 0.5.

47. The method of claim 39, where the thermal reference regions and associated support structure have a higher thermal mass than the sample wells and corresponding samples.

48. The method of claim 39, the sample wells having a central axis, where each thermal reference region includes an annular portion positioned about the central axis of a corresponding sample well.

49. The method of claim 48, the sample wells having a bottom, where each thermal reference region is positioned about or below the bottom of a corresponding sample well.

50. The method of claim 39, where the sample wells and corresponding thermal reference regions are separated by a gap along a line connecting each portion of the sample wells and the corresponding thermal reference regions to reduce heat transfer between the sample wells and thermal the reference regions.

51. The method of claim 39, each thermal reference region having an emissive reference surface, where the emissive reference surface includes a metal.

52. The method of claim 39, where the step of constructing a sample signal includes the step of subtracting a reference value from a corresponding measurement value, where the reference value is computed using the radiation detected from the thermal reference region, and where the measurement value is computed using the radiation detected from the sample.

53. The method of claim 52, where the step of constructing a sample signal includes the step of averaging the thermal infrared radiation detected from at least two different portions of the same sample.

54. The method of claim 52, where the step of constructing a sample signal includes the step of averaging the thermal infrared radiation detected from the same sample from at least two different times.

55. The method of claim 39, further comprising processing the sample signal to reduce the proportion of the sample signal that is attributable to noise.

56. The method of claim 55, where the step of processing the sample signal includes the step of computing a quantity based on distinguishable components of the sample signal representing thermal infrared radiation detected from the same sample at different times.

57. The method of claim 55, where the step of processing the sample signal includes the step of computing a quantity based on distinguishable components of the sample signal representing thermal infrared radiation detected from different portions of the same sample.

58. The method of claim 39, further comprising performing the steps of detecting thermal infrared radiation from a sample and an adjacent thermal reference region for a plurality of samples positioned in a corresponding plurality of sample wells in the sample plate.

59. The method of claim 58, further comprising:

repeating the step of constructing a sample signal for the plurality of samples; and

adjusting the sample signals so that each has the same preselected value at the same preselected relative time.

60. The method of claim 59, where the preselected value is zero.

61. The method of claim 59, where the preselected time is zero.

62. The method of claim 58, where the thermal infrared radiation is detected simultaneously from the plurality of samples.

63. The method of claim 58, where the thermal infrared radiation is detected sequentially from the plurality of samples.

64. The method of claim 39, the sample plate comprising an insert portion containing the sample wells and a support portion containing the thermal reference regions, further comprising forming the sample plate by mating the insert portion with the support portion.

65. The method of claim 39, where the optical device comprises:

an examination site; and

a detector configured to receive and preferentially to detect thermal infrared radiation transmitted from a sample positioned within a sample well at the examination site.

66. The method of claim 39, the sample wells having a central axis, the optical device having an optical axis, further comprising aligning the central axis and the optical axis prior to the steps of detecting thermal infrared radiation.

67. The method of claim 39, further comprising shielding the sample from incident radiation to reduce the proportion of the sample signal arising from transmission, reflection, and/or photoluminescence from the sample.

68. The method of claim 39, further comprising filtering the radiation transmitted from the sample to extract thermal infrared radiation prior to the step of detecting thermal infrared radiation.

69. The method of claim 39, where at least about half of the thermal infrared radiation detected by the optical device has a wavelength between about 3 micrometers and about 5 micrometers.

70. The method of claim 39, where at least about half of the thermal infrared radiation detected by the optical device has a wavelength between about 7 micrometers and about 14 micrometers.

71. The method of claim 39, further comprising computing a quantity related to a characteristic of the thermal infrared radiation transmitted from the sample.

72. The method of claim 71, where the quantity is representative of the temperature of the sample.

73. The method of claim 71, further comprising:

computing the quantity for a plurality of samples; and

displaying the quantities graphically in a manner representative of the arrangement of the corresponding sample wells in the sample plate.

74. The method of claim 39, further comprising covering the sample wells to reduce evaporation from the samples.

75. A system for detecting thermal infrared radiation, comprising:

a sample plate having a plurality of sample wells and a corresponding plurality of thermal reference regions positioned adjacent the sample wells;

an optical device configured preferentially to detect thermal infrared radiation transmitted from a sample positioned within at least one of the sample wells and from an adjacent thermal reference region; and

a processor configured to analyze the detected radiation and to construct a sample signal characteristic of the thermal infrared radiation detected from the sample based on the thermal infrared radiation detected from the sample and the adjacent thermal reference regional.

76. The system of claim 75, the sample plates having a central axis, the optical device having an optical axis along which radiation may be detected, where the optical device supports the sample plate such that the central axis is aligned with the optical axis.